**WASHINGTON DEPARTMENT OF ECOLOGY**

**ENVIRONMENTAL ASSESSMENT PROGRAM**

**FRESHWATER MONITORING UNIT**

**STREAM DISCHARGE TECHNICAL NOTES**

**STATION ID:** 19E060

**STATION NAME:** Deep Creek

**WATER YEAR:** 2007

**AUTHOR:** Casey Clishe

## Introduction

Watershed Description

The Deep Creek watershed contains one of three stations in the Intensively Monitored Watersheds (IMW) project, Strait of Juan de Fuca complex. The stream is approximately 7.9 miles long, the basin area is 17.3 square miles. Watershed elevations range from sea level to 3,020 feet. Precipitation falls primarily as rain between October and May, averaging 86 inches annually. Crescent formation volcanic rocks in the upper watershed, and marine sedimentary rock overlain by terraces of glacial deposits in the lower watershed, coarsely define the complex geology of the watershed. The primary land use for the last century has been commercial forestry. Three vegetation zones define the basin--Sitka spruce in the valley bottoms, Western hemlock in the low to mid elevations, and Silver fir in the headwaters. The fish species present include Coho salmon, chum salmon, steelhead or rainbow trout, cutthroat trout, Pacific lamprey, western brook lamprey, torrent sculpin,and reticulate sculpin.

Gage Location

The gaging station for Deep Creek is located in Clallam County, Washington, approximately 27 miles west of Port Angeles. Deep Creek is a tributary to the Strait of Juan de Fuca. The gage, placed on the left bank, is on the downstream side of the Highway 112 bridge at approximately river mile 0.2. The stage record is tidally influenced. Tidal spikes in the stage record are removed.

Table 1.

| | |
|---|---|
| Drainage Area (square miles) | 17.3 |
| Latitude (degrees, minutes, seconds) | 48 10 21 N |
| Longitude (degrees, minutes, seconds) | 124 01 36 W |

**Discharge**

Table 2. Discharge Statistics.

| | |
|---|---|
| Mean Annual Discharge (cfs) | 50.3 |
| Median Annual Discharge (cfs) | 15.5 |
| Maximum Daily Mean Discharge (cfs) | 456 |
| Minimum Daily Mean Discharge (cfs) | 1.7 |
| Maximum Instantaneous Discharge (cfs) | 653 |
| Minimum Instantaneous Discharge (cfs) | 1.7 |
| Discharge Equaled or Exceeded 10 % of Recorded Time (cfs) | 145 |
| Discharge Equaled or Exceeded 90 % of Recorded Time (cfs) | 3.2 |
| Number of Days Discharge is Greater Than Range of Ratings | 7 |
| Number of Days Discharge is Less Than Range of Ratings | 11 |

Note: Statistics displayed in Table 2 may not include values in which the predicted discharge exceeds the range of ratings.

**Narrative**

Seven of the highest days in the predicted discharge record were excluded from some statistics in Table 2. An additional twelve days were missing due to equipment failure. Some of these days were also during times of relatively high discharge. The mean annual discharge, median annual discharge, maximum daily mean discharge, and maximum instantaneous discharge in Table 2 are less than the actual values. The quality of the discharge record at Deep Creek for water year 2007 was compromised by several factors. Several data gaps in the stage record during the early autumn storms remain unfilled because of systematic and simultaneous failures at all IMW stations in the Strait of Juan de Fuca complex. Three large to moderately large storm events,- (the largest in January and then two others in February and March 2007) resulted in significant changes to the channel geometry. Discharge began declining toward baseflow in April 2007, but small precipitation events throughout spring and summer resulted in a departure from the "normal" summer time pattern of a steady seasonal decline.

**Error Analysis**

Table 3. Error Analysis Summary.

| | |
|---|---|
| Logger Drift Error (% of discharge) | d/n/a |
| Weighted Rating Error (% of discharge) | 6.4 |
| Total Potential Error (% of discharge) | d/n/a |

**Rating Table(s)**

Table 4. Rating Table Summary

| Rating Table No. | 301 | 4 | 5 |
|---|---|---|---|
| Period of Ratings | 10/01-02/24 | 02/17-03/30 | 03/08-09/30 |
| Range of Ratings (cfs) | 1.7-602 | 74- 978 | 2.8-988 |
| No. of Defining Measurements | 4 | 2 | 7 |
| Rating Error (%) | 6.2 | 6.0 | 6.6 |

| Rating Table No. | | | |
|---|---|---|---|
| Period of Ratings | | | |
| Range of Ratings (cfs) | | | |
| No. of Defining Measurements | | | |
| Rating Error (%) | | | |

| Rating Table No. | | | |
|---|---|---|---|
| Period of Ratings | | | |
| Range of Ratings (cfs) | | | |
| No. of Defining Measurements | | | |
| Rating Error (%) | | | |

**Narrative**

Rating 301, a replica of rating Table 3, predicted discharge for the beginning of water year 2007. Two large storm events in the winter of 2007 significantly scoured the control at Deep Creek resulting in a shift to rating 4. Rating 4 was both brief in nature and poorly developed. Only two discharge measurements defined rating 4. Two additional large storms in March 2007 again scoured the control resulting in another significant rating shift to Table 5. Table 5, coupled to the stage record, predicted discharge for the remainder of water year 2007.

**Stage Record**

Table 5. Stage Record Summary

| | |
|---|---|
| Minimum Recorded Stage (feet) | 0.33 |
| Maximum Recorded Stage (feet) | 6.91 |
| Range of Recorded Stage (feet) | 6.58 |
| Number of Un-Reported Days | 19 |
| Number of Days Qualified as Estimates | 15 |
| Number of Days Qualified as Unreliable Estimates | 0 |

**Narrative**

The stage record for water year 2007 was unusual in many respects. The record in October was continuous and complete while the stage (and discharge) remained at baseflow levels. Then, with the onset of the autumn rains and difficult to resolve equipment failure issues, several data gaps unfortunately and permanently punctuate the record. These gaps are associated with the peaks of relatively large precipitation events. The equipment issues were finally resolved in mid-February 2007. No further gaps in the record occurred for the remainder of the water year.

**Modeled Discharge**

Table 6. Model Summary

| | |
|---|---|
| Model Type (Slope conveyance, other, none) | none |
| Range of Modeled Stage (feet) | |
| Range of Modeled Discharge (cfs) | |
| Valid Period for Model | |
| Model Confidence | |

**Surveys**

Table 7. Survey Type and Date (station, cross section, longitudinal)

| Type | Date |
|---|---|
| station | 10/02/2007 |

**Activities Completed**

| |
|---|
| The turbidity threshold sampling initiative portion of the IMW project was launched. Early programming issues with the BASIC code resolved. The ISCO compositor is successfully pumping samples. |